

## **REFRIGERATING PLATE FOR A REFRIGERATOR OR FREEZER**

### **DESCRIPTION**

#### **Domain of the invention**

[01] The invention relates to a "roll-bond" type refrigerating panel for a refrigerator or freezer improving the thermal efficiency of the cooling circuit and reducing the sound level during operation.

#### **State of the art**

[02] The cooling circuit of a refrigerator or a freezer comprises a compressor designed to propel the cooling liquid, for example a fluorinated or chlorofluorinated hydrocarbon or an alkane, and an evaporator that can be in the form of a vertical panel, and also a panel with horizontal planes, for example in the plane separating the two compartments, for refrigerators with a freezer compartment.

[03] One of the methods of manufacturing the evaporating panel consists of making the cooling circuit using the so-called "roll bond" technique, in other words using two aluminum or aluminum alloy strips, one of which is coated, on the zones that will form the circuit, with an ink designed to prevent the two strips from being welded together. The two strips are then welded by co-rolling. The unwelded areas are then inflated hydraulically or pneumatically to form the circuit, which may be of the two side type with two deformed sides, or of the OSF (One Side Flat) type, with one flat side and one deformed side.

[04] The circuit can comprise a sequence of channels with a part descending towards the bottom of the panel and a part ascending towards the top of the panel, possibly with a widened area near the end of the circuit used as an evaporator, wherein evaporation is terminated regardless of the external conditions. When the compressor stops, the refrigerant migrates from the condenser to the evaporator because the high pressure in the condenser forces it towards the low pressure area consisting of the evaporator, the lack of a solenoid valve making it impossible to isolate the high pressure zone from the low pressure zone. The refrigerant migrates in a two-

phase liquid/gas form via gravity, and the liquid part descends towards the lowest point of the circuit and collects there.

[05] Particularly when there is no solenoid valve between the compressor and the evaporator, the compressor forces the gas into a large mass of liquid when it starts, thus causing audible gurgling.

[06] Furthermore, household appliance manufacturers are continuously attempting to reduce electrical consumption to claim this feature as a benefit for consumers or to comply with the regulations.

[07] An object of this invention is to provide a vertical roll-bond type evaporator panel for a refrigerator or freezer capable of reducing energy consumption and reducing the sound level in the evaporator.

#### **Purpose of the invention**

[08] An object of the invention is to provide a vertical evaporating panel for cooling a refrigerator or a freezer. The panel comprises a roll bond type circuit consisting of refrigerant flow channels and comprising a descending part and an ascending part, wherein at least some of the channels of the descending part comprise a refrigerant accumulating area with a maximum height  $h_i$ . The totality of the heights  $h_i$  can be adjusted such that the total volume of the accumulating areas is greater than or equal to half the total volume of the cooling liquid and each height  $h_i$  is less than 70% the total height of the channel,  $H_i$ .

#### **Description of the figures**

[09] Figure 1a shows a vertical section through an element of a channel in a panel according to the invention comprising a siphon delimiting the cooling liquid accumulating area.

[10] Figure 1b shows another embodiment of the accumulating area of a channel according to the invention comprising projections.

[11] Figure 1c shows an element of the channel combining the two embodiments in figures 1a and 1b.

[12] Figure 1d shows an evaporator type channel according to the invention.

[13] Figure 2 shows an exemplary complete panel according to the invention.

### **Description of the invention**

[14] The invention consists generally of providing channels in the descending part of an evaporating circuit comprising refrigerant accumulating areas so as to inhibit this liquid from completely filling in the channels at the bottom of the circuit. These accumulating areas are present on either only part or on all of the channels, and enable a relatively uniform distribution of liquid in the panel when the compressor stops, provided that the total volume of the accumulating areas is greater than or equal to half the total volume of the cooling liquid, such that the sound level is minimized when the compressor starts again.

[15] However, it is important to prevent the accumulation of the cooling liquid from excessively reducing the passage of gas produced by evaporation of the cooling liquid, which could be detrimental to the thermal efficiency of the appliance. Consequently, the height  $h_i$  of liquid in the accumulating area must be sufficient but must not exceed 70% of the total height  $H_i$  of the channel.

[16] There are several possible embodiments for the accumulating area. The embodiment shown in figure 1a consists of making a siphon, the channel being curved upwards to trap a certain volume of cooling liquid, but leaving a sufficient passage for the gas.

[17] The embodiment shown in figure 1b consists of providing vertical projections facing downwards on the channels for accumulation of cooling liquid, which have the advantage of not reducing the cross-sectional passage for gas in the channels. When the compressor is running, these projections enable evaporation of the cooling liquid directly in areas remote from the channels, which contributes to cooling these areas and therefore improving the thermal efficiency of the circuit. The example shown in figure 1c combines the two previous embodiments.

[18] The example shown in figure 1d shows the use of boiler type channels, in other words wide channels with disk-shaped welded parts. The use of these disk-shaped parts enables

an increase in the width of the channels while reducing their deformation under the action of internal pressure of the refrigerant under some operating conditions or during tests to detect any leaks in the evaporators before the refrigerator or the freezer is assembled. The disk-shaped parts must not excessively reduce the surface area of the passage of the gas that evaporates from the accumulating area, which despite the presence of the accumulating areas according to the invention, would increase the sound level. Thus, the sum of the widths  $l_i$  of the disk-shaped parts in a boiler area must not exceed 90% of the total length  $L$  of this boiler area.

[19] Figure 2 shows an example of a complete panel in which most ends of the horizontal channels of the descending part of the circuit are siphon-shaped, with the lower channel comprising projections.

[20] The refrigerating panels according to the invention reduce electrical consumption and the sound level of the refrigerator or freezer.